FY04-L(50)-125

"Large-Scale Mercury Control Technology Testing for Lignite-Fired Utilities—Oxidation Systems for Wet FGD"

Contractor: Energy & Environmental Research Center
Principal Investigator: Steve Benson

PARTICIPANTS

Sponsor	Cost Share
Basin Electric Power Cooperative	$ 1,993
Great River Energy	$ 2,073
Minnkota Power Cooperative	$ 66,312
Ottertail Power Cooperative	$ 979
Montana Dakota Utilities	$ 625
SaskPower	$ 46,150
Falkirk Mine	$ 1,092
Westmoreland	$ 1,092
BNI	$ 1,092
Coteau Mine	$ 1,092
ADA-ES	$104,500
EPRI	$ 71,000
TXU	$ 78,072
NDIC	$172,500
DOE	$1,602,295
Total Cost	$2,150,767

Project Schedule - 36 Months

Contract Date – 2/25/04

Start Date – 2/25/04

Completion Date – ~~9/30/06~~

Extension to – 3/31/07

Project Deliverables

Contract Signed: 2/25/04(✓)

Quarterly Reports: 12/31/03 (✓)

3/31/04(✓); 6/30/04(✓); 9/31/04(✓);

12/31/04✓); 3/31/05(✓); 6/30/05(✓);

9/31/05(✓); 12/31/05(✓);

3/31/06(✓); 6/30/06(✓)

Final Report: 9/30/06( )

OBJECTIVE / STATEMENT OF WORK:

Demonstrate a mercury "chemical addition" oxidation process in flue gas upstream of pollution control equipment, specifically, electrostatic precipitators followed by wet scrubbers. Host sites are Minnkota Power Cooperative MRY (*cyclone-fired*, ESP wet scrubber) Unit 2 and Texas Utilities Monticello (*wall-fired*, ESP, wet scrubber) Unit 3.

STATUS

Oct – Dec 2003

A kick-off meeting was held in Nov, 2003 in Pittsburgh to officially kick off the project. Field tests will begin in approximately one year. Near-term needs will focus on preliminary planning, design and fabrication

of equipment, drafting of site-specific test plans, and completed design of ash corrosion probes and furnace ports at the MRY Station identified for placement.

Jan – Mar 2004. Activities this quarter included drafting test plans for the MRY and Monticello Stations.

April – June 2004. The additive system and the corrosion probes that will be used in this program were successfully used in testing at the Leland Olds Station under a related program. The probes will be used to determine the potential impact that chlorine introduced into the boiler will have on corrosion.

July – September 2004. Testing for the MRY Station is scheduled for the 1st Quarter of 2005. Site-specific test plan preparation, and design and fabrication of additive equipment is on-going.

September – December, 2004. Detailed planning for the MRY plant is on-going with testing scheduled to begin in February, 2005. Corrosion probes to define baseline conditions were removed after 8 weeks of exposure.

January – March, 2005. The sorbent injection skid for the oxidizing agent and sorbent injection have been installed in the MRY plant. Baseline corrosion probes were undergoing analysis & new probes installed for the upcoming 4 week test. A draft test plan is under review by the project sponsors and participants.

April – June, 2005. Baseline and parametric tests at the MRY II (ESP, Wet FGD) plant were completed in April, 2005 using three injection rates of powered activated char (PAC). Testing continued with SEA1, SEA 2 and magnesium chloride, followed by a combination of both PAC and SEA 1 & 2. SEA 1 was not particularly effective at oxidizing mercury, indicating only 16% reduction. SEA 2 achieved a 44% reduction, although the target was 50%. It is thought that the ash high sodium content reduces the injected SEA oxidation chemicals. At high levels of SEA 1and PAC, roughly 53% of the elemental mercury was captured. The target removal was 55 %.

July – September, 2005. An extended test, following parametric tests, were conducted using a PAC, SEA (proprietary oxidation chemicals) and a combination of PAC to demonstrated mercury removal rates up to 50% or more. Removal rates as high as 75% (spikes) was achieved with only SEA, but at very high rates; PAC injection was required to achieve a more consistent mercury capture rate of about 55%. A preliminary conclusion is that achieving a consistent 50% capture rate would require high SEA injection rates. As the overall test was in progress, the cost of SEA increased significantly. An important concern is boiler corrosion, as shown by coupon probes inserted in the boiler to characterize metal waste. It appears to be an issue; laboratory analyses are on-going.

October – December, 2005. Full-scale boiler halogen injection tests were performed at the TXU's Monticello Steam Electric (MoSES) Unit 3 to evaluate mercury oxidation and removal across a cold-side ESP/wet FGD system in a Texas lignite-derived flue gas stream. Short-term parametric tests were followed by 2-week continuous chemical injection tests. Results will be presented in the next quarterly report.

January – March, 2006. Samples and data collected during the chemical injection tests were analyzed from the tests conducted at MoSES Unit 3. The average mercury removal across the ESP/FGD system was 59% at an average injection rate of 113 ppm Bromine in the coal. At the MRY plant, SEA2 additive may be contributing to corrosion in the economizer and AHI long-term test coupons. Additional investigation into this will occur in the next quarter.

April – June, 2006. The ESP and wet FGD at MRY Unit 2 were very inefficient at removing Hg from eh lignite coal combustion flue gas, primarily because elemental mercury was dominant. Additions of SEA2 combined with 0.15 lb/Macf PAC yielded removal efficiencies in the range of 50% to 65%.